CLAIMS

What is claimed is:

1. An apparatus, comprising:

a free-space optical communication terminal having:

a mounting fixture to allow at least a portion of the communication terminal to be mounted to a window; and

a feature to allow the communication terminal to compensate for characteristics of the window onto which the communication terminal is mounted via the mounting fixture.

2. The apparatus of claim 1 wherein the mounting fixture allows the communication terminal to be mounted to an indoor surface of the window.

3. The apparatus of claim 1 wherein the mounting fixture allows the communication terminal to be mounted to an outdoor surface of the window.

4. The apparatus of claim 1 wherein the mounting fixture comprises glue between the portion of the communication terminal and a surface of the window.

5. The apparatus of claim 1 wherein the mounting fixture comprises a plate to support the communication terminal, and wherein the plate is structured to be attached to the window.

6. The apparatus of claim 1 wherein the mounting fixture comprises a fastener device to fasten the portion of the communication terminal to a surface of the window.

7. The apparatus of claim 6 wherein the fastener device comprises at least one of a hook and loop fastener, a passive vacuum device, an active vacuum device, a bracket, a screw, and a rivet.

8. The apparatus of claim 1 wherein one of the characteristics of the window includes vibration of the window, and wherein the feature to allow the communication terminal to compensate for characteristics of the window includes a fast steering mechanism to compensate for positional changes of the communication terminal caused by the vibration of the window.

9. The apparatus of claim 8 wherein the fast steering mechanism comprises a steering mirror to steer a light beam received by the communication terminal onto a position sensor, the steering mirror being configured to move to maintain alignment of the light beam on the position sensor, as positional changes of the communication terminal occur as a result of the vibration of the window.

10. The apparatus of claim 8 wherein the fast steering mechanism comprises:

a mirror to direct a light beam received by the communication terminal onto a position sensor; and

an actuator to adjust a position of an optical subassembly of the communication terminal, if the communication terminal undergoes a positional change as a result of the vibration of the window, as detected by the position sensor via the light beam directed onto the position sensor by the mirror.

11. The apparatus of claim 1 wherein one of the characteristics of the window includes a stress limit of the window, and wherein the feature to allow the communication terminal to compensate for characteristics of the window includes a weight of the communication terminal that is selected to be within the stress limit of the window.

12. The apparatus of claim 1 wherein one of the characteristics of the window includes an area of the window, and wherein the feature to allow the communication terminal to compensate for characteristics of the window includes a size of the communication terminal that is selected to reduce occupation of the area of the window.

13. The apparatus of claim 1 wherein the feature to allow the communication terminal to compensate for characteristics of the window includes a common aperture to transmit into free space and to receive from free space an optical signal having a transmit beam at a first wavelength and a receive beam at a second wavelength, respectively.

14. The apparatus of claim 1, further comprising a ceiling fixture capable of being attached to a ceiling adjacent to the window and from which the communication terminal can be coupled, the portion of the communication terminal capable of being placed in contact with the window via the mounting fixture in a manner that mechanically isolates the communication terminal from the ceiling fixture.

15. The apparatus of claim 1, further comprising a wall fixture capable of being attached to a wall adjacent to the window and to which the communication terminal can be coupled, the portion of the communication terminal capable of being placed in contact with the window via the mounting fixture in a manner that mechanically isolates the communication terminal from the wall fixture.

16. The apparatus of claim 1, further comprising a frame fixture capable of being attached to a frame adjacent to the window and to which the communication terminal can be coupled, the portion of the communication terminal capable of being placed in

contact with the window via the mounting fixture in a manner that mechanically isolates the communication terminal from the frame fixture.

17. The apparatus of claim 1, further comprising a floor fixture capable of being attached to a floor adjacent to the window and to which the communication terminal can be coupled, the portion of the communication terminal capable of being placed in contact with the window via the mounting fixture in a manner that mechanically isolates the communication terminal from the floor fixture.

18. The apparatus of claim 1 wherein the mounting fixture comprises a corner fixture that allows the portion of the communication terminal to be mounted adjacent to a corner of the window.

19. An apparatus usable in a free-space optical communication system, the apparatus comprising:

a free-space optical communication terminal having:

a mounting fixture to mount at least a portion of the communication terminal to a surface of a window to allow the communication terminal to receive a light beam from the free-space optical communication system; and

a feature to allow the communication terminal to compensate for dynamics of the window onto which the communication terminal is mounted via the mounting fixture.

20. The apparatus of claim 19 wherein the surface of the window comprises an indoor surface, and wherein the mounting fixture is structured to mount the communication terminal to the indoor surface of the window.

21. The apparatus of claim 19 wherein the mounting fixture comprises glue between the portion of the communication terminal and the surface of the window.

22. The apparatus of claim 19 wherein the mounting fixture comprises a plate to support the communication terminal, and wherein the plate is structured to be attached to the surface of the window.

23. The apparatus of claim 19 wherein the mounting fixture comprises a fastener device to fasten the portion of the communication terminal to the surface of the window.

24. The apparatus of claim 19 wherein the dynamics of the window include vibration of the window, and wherein the feature to allow the communication terminal to compensate for the dynamics of the window includes a fast steering mechanism to compensate for positional changes of the communication terminal caused by the vibration of the window.

25. The apparatus of claim 19 wherein the window has characteristics including a stress limit and an area, the communication terminal further including additional features to compensate for the characteristics of the window, the additional features comprising:

a weight of the communication terminal that is selected to be within the stress limit of the window; and

a size of the communication terminal that is selected to reduce occupation of the area of the window.

26. The apparatus of claim 19 wherein the window has characteristics including a stress limit and an area, the communication terminal further including a common aperture to transmit into free space and to receive from free space an optical signal

having a transmit beam at a first wavelength and the light beam at a second wavelength, respectively, the common aperture being configured to allow the communication terminal to be within the stress limit of the window and to reduce occupation of the area of the window.

27. The apparatus of claim 19, further comprising another fixture capable of being attached to a building structure adjacent to the window and to which the communication terminal can be coupled, the portion of the communication terminal capable of being placed in contact with the window via the mounting fixture in a manner that mechanically isolates the communication terminal from the another fixture.

28. An apparatus, comprising:

a free-space optical communication transceiver having:

a mounting fixture to mount at least a portion of the communication transceiver to a surface of a window to allow the communication transceiver to communicate with the free-space optical communication system;

a feature to allow the communication transceiver to compensate for dynamics of the window onto which the communication transceiver is mounted via the mounting fixture; and

a common aperture to transmit into free space and to receive from free space an optical signal having a transmit beam at a first wavelength and a receive beam at a second wavelength, respectively.

29. The apparatus of claim 28 wherein the feature to allow the communication terminal to compensate for dynamics of the window comprises a tracking system including a movable steering mechanism and a position sensor, wherein the movable

steering mechanism is operatively coupled to receive the optical signal from free space and to steer the optical signal onto the position sensor.

30. The apparatus of claim 28 wherein the movable steering mechanism includes at least one of a movable steering mirror, lens, and gimbal system with actuators.

31. The apparatus of claim 28 wherein the position sensor includes at least one of a quadrant-cell detector, a lateral effect cell, a fast charge coupled device (CCD), a complementary metal oxide semiconductor (CMOS) camera, and a data detector in cooperation with a steering mechanism to perform nutation.

32. The apparatus of claim 29, further comprising a controller operatively coupled to process an output of the position sensor.

33. The apparatus of claim 28 wherein the communication transceiver further comprises:

a first beam splitter;

a second beam splitter; and

a detector, wherein the first beam splitter is operatively coupled to separate the optical signal into the transmit beam and the receive beam and to direct the receive beam to the second beam splitter, and the second beam splitter is operatively coupled to direct a first portion of the receive beam to the position sensor and a second portion of the receive beam to the detector.

34. The apparatus of claim 33, further comprising a filter operatively coupled to filter unwanted signals from the receive beam prior to direction of the receive beam to the second beam splitter.

35. The apparatus of claim 28, further comprising:

a beam splitter; and

opto-electronics, wherein the opto-electronics are operatively coupled to direct the transmit beam to the beam splitter.

36. The apparatus of claim 35, further comprising an optical fiber operatively coupled between the opto-electronics and the beam splitter.

37. The apparatus of claim 35 wherein the beam splitter is structured to combine the transmit beam and the receive beam into the optical signal.

38. The apparatus of claim 37, further comprising:

a movable steering mechanism;

a lens; and

a mirror, wherein the movable steering mechanism is operatively coupled to direct the optical signal from the beam splitter to the lens, wherein the lens is operatively coupled to focus the optical signal onto the mirror, and wherein the mirror is operatively coupled to direct the optical signal to free space.

39. The apparatus of claim 28, further comprising:

opto-electronics;

a light source; and

a beam splitter, wherein the opto-electronics are operatively coupled to direct an electrical signal to the light source, wherein the light source is configured to convert the electrical signal to the transmit beam and to direct the transmit beam to the beam splitter, and wherein the beam splitter is structured to combine the transmit beam and the receive beam into the optical signal.

40. The apparatus of claim 29 wherein the mirror is further operatively coupled to fold the optical signal at a predetermined angle.

41. The apparatus of claim 29 wherein the steering mechanism comprises at least one actuator driven by at least one precision motion device.

42. The apparatus of claim 28 wherein the mounting fixture comprises glue between the portion of the communication transceiver and the surface of the window.

43. The apparatus of claim 28 wherein the mounting fixture comprises a fastener device to fasten the portion of the communication transceiver to the surface of the window.

44. The apparatus of claim 28 wherein the dynamics of the window include vibration of the window, and wherein the feature to allow the communication transceiver to compensate for the dynamics of the window includes a fast steering mechanism to compensate for positional changes of the communication transceiver caused by the vibration of the window.

45. The apparatus of claim 28 wherein the window has characteristics including a stress limit and an area, the communication transceiver further including additional features to compensate for the characteristics of the window, the additional features comprising:

a weight of the communication transceiver that is selected to be within the stress limit of the window; and

a size of the communication transceiver that is selected to reduce occupation of the area of the window.

46. The apparatus of claim 28, further comprising another fixture capable of being attached to a building structure adjacent to the window and to which the communication transceiver can be coupled, the portion of the communication

transceiver capable of being placed in contact with the window via the mounting fixture in a manner that mechanically isolates the communication transceiver from the another fixture.

47. A system, comprising:

a first free-space optical communication transceiver having a common aperture to transmit into free space and to receive from free space a transmit beam at a first wavelength and a receive beam at a second wavelength, respectively; and

a second free-space optical transceiver to receive the transmit beam from the first free-space optical communication transceiver via free space and to transmit the receive beam to the first free-space optical communication transceiver via free space,

wherein at least one of the communication transceivers includes:

a mounting fixture to allow at least a portion of that communication transceiver to be mounted to a window; and

a feature to allow that communication transceiver to compensate for characteristics of the window onto which that communication transceiver is mounted via the mounting fixture.

48. The system of claim 47 wherein the mounting fixture comprises glue between the portion of the communication transceiver and a surface of the window.

49. The system of claim 47 wherein the mounting fixture comprises a fastener device to fasten the portion of the communication transceiver to a surface of the window.

50. The system of claim 47 wherein the characteristics of the window include vibration of the window, and wherein the feature to allow the communication transceiver to compensate for the characteristics of the window includes a fast

steering mechanism to compensate for positional changes of the communication transceiver caused by the vibration of the window.

51. The system of claim 47 wherein the characteristics of the window includes a stress limit and an area, and wherein the feature to compensate for the characteristics of the window comprises:

a weight of the communication transceiver that is selected to be within the stress limit of the window; and

a size of the communication transceiver that is selected to reduce occupation of the area of the window.

52. The system of claim 47 wherein the at least one communication transceiver further comprises another fixture capable of being attached to a building structure adjacent to the window and to which the communication transceiver can be coupled, the portion of the communication transceiver capable of being placed in contact with the window via the mounting fixture in a manner that mechanically isolates that communication transceiver from the another fixture.

53. The system of claim 47 wherein the feature to compensate for the characteristics of the window comprises an increased divergence in transmit and an increased receive field-of-view.

54. The system of claim 47 wherein the characteristics of the window includes a stress limit, and wherein the feature to compensate for the characteristics of the window comprises a common aperture for transmit and receive beams and that can accommodate a single steering mechanism to allow the communication transceiver to be within the stress limit.

55. A method, comprising:

mounting a free-space optical communication terminal to a windowpane;

transmitting a first light beam into free space using the free-space optical communication terminal mounted to the windowpane; and

receiving a second light beam from free space using the free-space optical communication terminal mounted to the windowpane.

56. The method of claim 55 wherein mounting the free-space optical communication terminal to the windowpane includes directly gluing at least a portion of the free-space optical communication terminal to a surface of the windowpane.

57. The method of claim 55 wherein mounting the free-space optical communication terminal to the windowpane includes fastening at least a portion of the free-space optical communication terminal to a surface of the windowpane with a fastener device.

58. The method of claim 55, further comprising coupling the free-space optical communication terminal to a building structure adjacent to the windowpane via a fixture in a manner where at least a portion of the free-space optical communication terminal is in contact with the windowpane while mechanically isolating the free-space optical communication terminal from the fixture.

59. The method of claim 55 wherein mounting the free-space optical communication terminal to the windowpane includes mounting the free-space optical communication terminal adjacent to a corner of the windowpane.

60. The method of claim 55, further comprising mounting a plurality of free-space optical communication terminals to at least one of a corresponding plurality of windowpanes and to a single windowpane.